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ABSTRACT

The objectives of this module on making comparisons and ratios include using ratios to compare sets of objects and expressing ratios as decimals or fractions in lowest terms. The module provides six experiments. An envelope of manipulatives accompanies each of the first three experiments. The fourth experiment requires a multispeed bicycle. The fifth experiment requires the building of a gearboard. As an optional experiment, the student may be involved in small group work with a deck of cards. The module contains three enrichment cards which involve students in "real-life" problem situations. It also contains directions for utilizing a programmable calculator or computer. (Author/MK)

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# TOPICAL MODULE FOR USE

# IN A

# MATHEMATICS LABORATORY SETTING

TOPIC: Making Comparisons - Ratios

by

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A Publication of

University of Denver
Mathematics Laboratory
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SE 030 318

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TEACHER'S GUIDE

Making Comparisons - RATIOS

This module may be used in a variety of ways.

1. It may be used with a pretest as suggested in the teacher's guide.
2. Groups of students may be assigned to various experiments according to past performance.
3. The class may be divided so each group has a group leader who has the ability to help the other students.
4. Teachers may use a group-method of their own choosing or the entire class.

MATERIALS

.Contained in this Module:

1. A packet containing 25 square paper chips. (SW #1)
2. A packet containing 5 pieces of colored yarn. (SW #2)

.Teacher must provide:

1. 25 cubes or 25 rods (cuisenaire) of various colors. (Intro. SW)
2. Ruler (SW #2)
3. Three-speed, five speed or ten-speed bicycle (SW #4)

.Optional (Teacher provides)

1. Gear Box (teacher or student built)(SW #5)
2. Deck of playing cards. (SW #6)

TIME SCHEDULE

.During field testing, this module took an average of _____ fifty-minute class periods to complete.

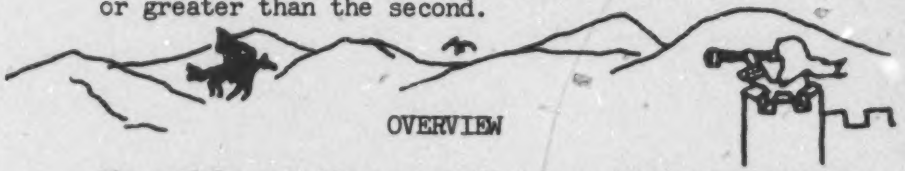
OBJECTIVES

.Given two different sets of objects, the student will use ratios to compare them.

.Given two equivalent fractions, the student will state that they express the same ratio.

.When asked to make a comparison, the student will be able to express the ratio as a decimal or as a fraction in lowest terms.

.When asked to compare two ratios, the student will be able to identify the first as less than, equal to, or greater than the second.



OVERVIEW

.The module provides an audio tape, which directs the student through the set of accompanying exercises where he manipulates colored cubes. It also emphasizes the concept of ratio as a comparison by division.

.The module provides six experiments. An envelope of manipulatives accompanies each of the first three experiments. The student may use these to complete the accompaning worksheets. The fourth experiment requires a multiple-speed bicycle. The fifth experiment requires the building of a gearboard.

.As an optional experiment, the student may be involved in small group work with a deck of cards.

.The module contains three enrichment cards, which involve students in "real-life" problem situations. It also contains directions for utilizing a programmable calculator or computer.



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## TESTING PROCEDURE

I. Pretest

A. The pretest checks the behavior entry level of the students to determine if they need additional preparation before beginning work on this module.

B. If the student is unsuccessful on the pre-test, then s(he) should be directed to pre-module materials.

II. Pre-Module Experiences

A. Students whose scores on the entry level test indicate they need additional preparation will likely profit most from the use of concrete materials such as cuisenaire rods, stern blocks or teacher-made aids.

B. It may be helpful to have another student help the student go through this type of commercial material.

C. If no pre-module materials are available, the student should begin with the introductory lesson in this module.

III. Posttest

A. The posttest checks to see if the student is able to successfully complete the objectives established for this module.



## OUTLINE

I. Introduction Lesson

A. Teaching suggestions

1. Allow students to work on this unit independently or as an entire class.
2. Students may be provided with the answer key.

B. Materials supplied

1. Students are given a set of 25 cubes or rods
   a. These are provided by the teacher
   b. If the set consists of 8 red, 7 green, 5 blue, 1 white, and 4 yellow cubes, then the answers provided below are correct.

C. Work to be completed by the student
1. Introductory worksheet if set of 25 cubes or rods are provided

Cut out and laminate or place on card board

Answer Key - Introductory Lesson - Ratio

1) 8 red, 7 green
2) 8, 7
3) 7, 18
4) 7, 18
5) 15
6) 8, 15
7) 5, 7
8) 8, 5, 8, 5
9) 12, 1
10) 8:5
11) 13:25
12) 9:12
13) 5:7, 1:5, 9:12

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## II. Experiment #1

### A. Teaching suggestions

1. If students had no difficulty with the introductory lesson, this experiment may be omitted.

### B. Materials supplied

1. Give students Activity Card #1 and Student Worksheet #1, along with the envelope provided containing colored chips. (15 red, 10 blue, 8 green, 6 yellow, and 5 white.)

### C. Work to be completed by the student

1. Questions on Activity Card #1
2. Student Worksheet #1
3. Have the students place their answers to the questions on the Activity Card on the back of Student Worksheet #1. (They should be encouraged not to write on the activity card since this module can be repackaged.)

### D. Variations to the lesson

1. Provide envelopes containing various numbers of chips.

Answer Key - Student Worksheet #1 - Ratio

1) 6 to 44 2) 6 to 15 3) 5/8

4) 5 : 25 5) $\frac{18}{6} = \frac{3}{1} = 3$ 6) $\frac{44}{5}$

7) 30 : 6 or 5 : 1 8) $\frac{15}{18} = \frac{5}{6}$

9) $\frac{15}{15} = \frac{1}{1} = 1$ 10) 14 : 44 = 7 : 22 or $\frac{7}{22}$

## III. Experiment #2

### A. Teaching suggestions

1. This experiment provides a different type of model (linear measurement) for the student to use when making comparisons to determine a ratio.
2. Students should be told to round off measurements to the nearest whole inch.
3. Have students use a ruler when checking comparisons.
4. The results of their comparisons are recorded on a chart. Students should be encouraged to complete Student Worksheet #2 independently.

### B. Materials supplied

1. Students are given an envelope containing five pieces of colored yarn. Their color and lengths are: red—24 inches; green—18 inches; blue—9 inches; pink—6 inches; white—4 inches.
2. They are provided with Student Worksheet #2.



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C. Work to be completed by student

1. Measure the lengths of various pieces of yarn.

2. Complete Student Worksheet #2.

Answer Key - Student Worksheet #2 - Ratio

1) 24 to 2 or 12 to 1

2) 6 to 20 or 3 to 10

3) $\frac{24}{4} = \frac{6}{1}$

4) 2/3

5) 6:26 or 3:13

6) 2/3

7) 42:15 or 14:5

8) $\frac{6}{1}$

9. $\frac{2}{15}$

10) 39:24 or 13:8

IV. Experiment #3

A. Teaching suggestions

1. This experiment provides additional practice where the student compares given data as ratios.

2. Students may experience some difficulty simplifying the fractions.

3. You may wish to replace the data sheets with statistics from an athletic event your school participated in.

B. Materials supplied

1. Students are given an envelope which contains data sheets for Student Worksheet #3A and Student Worksheet #3B.





C. Work to be completed by the student

1. Using the data sheets, students will complete Student Worksheet #3A and Student Worksheet #3B.

| | Vikings | Lions | Ratio of Vikings to Lions | Ratio as a fraction | Simplest fraction |
|---|---|---|---|---|---|
| First Downs | 17 | 12 | 17:12 | 17/12 | 17/12 |
| Rushing Yards | 188 | 172 | 188:172 | 188/172 | 47/43 |
| Passing Yards | 84 | 30 | 84:30 | 84/30 | 14/5 |
| Total Offense | 272 | 202 | 272:202 | 272/202 | 136/101 |
| Fumbles | 3 | 5 | 3:5 | 3/5 | 3/5 |
| Penalties | 20 | 85 | 20:85 | 20/85 | 4/17 |
| Score | 17 | 14 | 17:14 | 17/14 | 17/14 |
| | **Packers** | **Bears** | **Ratio of Packers to Bears** | **Ratio as a fraction** | **Simplest fraction** |
| First Downs | 28 | 4 | 28:4 | 28/4 | 7/1 |
| Rushing Yards | 286 | 17 | 286:17 | 286/17 | 286/17 |
| Passing Yards | 102 | 86 | 102:86 | 102/86 | 51/43 |
| Total Offense | 388 | 103 | 388:103 | 388/103 | 388/103 |
| Fumbles | 2 | 4 | 2:4 | 2/4 | 1/2 |
| Penalties | 15 | 30 | 15:30 | 15/30 | 1/2 |
| Score | 35 | 10 | 35:10 | 35/10 | 7/2 |

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V. Experiment #4

A. Teaching suggestions

1. Because of the hazards, this experiment should be teacher directed.

2. This experiment is highly motivational.

3. Students should be encouraged to try the experiment on several types of bicycles. If they use a ten-speed bicycle, Student Worksheet #4 will have to be extended to 10 columns.

4. It is important that the brake handle for the rear wheel be tied down so the rear wheel does not coast and cause ambiguous results.

B. Materials supplied

1. Students will need a three-speed, five-speed or ten-speed bicycle.

2. They will need chalk to mark off the rear wheel.

3. They should be provided with Student Worksheet #4. (Note: they will need teacher guidance as the directions are not included on Student Worksheet #4.)

C. Work to be completed by the student

1. Students will collect their own data by actual experiment.

2. They will complete Student Worksheet #4.



Answer Key - Student Worksheet #4 - Ratios

Students should verify their answers by comparing their work with classmates. If their results are not consistent, they should check their results and decide who is right.

VI. Experiment #5 (Optional)

A. Teacher suggestions

1. It is necessary to build the gears, gear holders, and gearbox out of masonite (or plywood) and wooden dowels. This is technical work and requires a jigsaw. Perhaps a student could be assigned this as a project. Do not expect students to do this construction as part of the experiment.

2. If the students are provided with the gear box, they should complete Student Worksheet #5 independently.

B. Materials supplied

1. Students need the gears and gear box.

2. They should be provided with Student Worksheet #5.

C. Work to be completed by the student

1. Students will complete Student Worksheet #5.



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1.

| Name of Gear | Number of times rotated (Fractional Part of complete Rotation) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | 2 | 1/2 | 5 | 4/3 | 1/3 | 10/3 | 2/3 | 1/6 | 5/3 | 1/6 | 1/9 |
| B | 3/2 | 3 | 3/4 | 15/2 | 2 | 1/2 | 5 | 1 | 1/4 | 5/2 | 3/4 | 1/6 |
| C | 3 | 6 | 3/2 | 15 | 4 | 1 | 10 | 2 | 1/2 | 5 | 1/2 | 1/3 |

2. A. 30 B. 20 C. 10

3. a. $\frac{3}{2}$ b. $\frac{3}{1}$ or 3 c. $\frac{2}{1}$ or 2

4. This is a fairly difficult abstraction. Note that the ratio of teeth in A to teeth in B is represented by the same fractional number as the number of times B is rotated when A rotates once. This is the usual generalization. Encourage others.

VII. Optional lesson using playing cards

A. Suggestions to the teacher

1. This activity requires a complete deck (52 cards).

2. This lesson might be used instead of the introductory lesson if a set of cubes or rods is not available.

3. Students might work together in teams of two or three on this experiment.

B. Materials supplied

1. A complete deck (52 cards) of playing cards.

2. Students should be provided with Student Worksheet #6.

C. Work to be completed by the student

1. Students will complete Student Worksheet #6.

Answer Key - Student Worksheet #6 - Ratios

| | | |
|---|---|---|
| 1. 26, 26 | 2. 2, 12 | 3. 6, 13 |
| 4. 52, 40 | 5. 26, 6 | 6. 12, 13 |
| 7. 13, 6 | 8. 26, 13 | 9. 26, 13 |
| 10. 32 to 52 | 11. 6:20<br>20:13<br>13:13 or 1:1 | |

VIII. Enrichment Cards

A. Teacher Suggestions

1. If the pretest was used, those students who scored 90% or higher (depending on teacher discretion) may be given an enrichment card to investigate.

2. These may be used as extension work for students who have completed the unit.

B. Answer Key

1. The Answer Key has been provided at the bottom of the enrichment card. These may be cut off before the student is given the card.

IX. Computer Experiments



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## Answer Key - Ratio

Pretest

1. a. 1/2 b. 4/5 c. 25/32

2. a. .5 b. 3/10 c. .625

3. a. 1/3 b. 2/5 c. 3/6 = 1/2 d. 1/4

Posttest

1. a. 2/3 b. 3/5 c. 4/5 d. 4/8 1/2
   e. 7/15

2. a. F b. T c. F

3. a. = b. < c. <

4. a. 2/4 = 1/2 b. 1/4 c. 2/6 = 1/3

5. a. 3/7 b. 3/11 c. 4/13

6. a. 1/6 b. 5/6 c. 5/6 d. 2/6 = 1/3

7. a. .5 b. 4/10 = 2/5 c. 6-2/10 = 6=1/5
   d. 24/100 = 6/25 e. .875

8. a. 1 b. 12 c. 6 d. 2

9. a. 2-1/2 b. 18/9

# RATIO PRETEST

Name _____

Score _____

Time _____

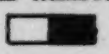
(10 points for each problem)

1. Reduce each fraction to its simplest form.
   Example: 2/4 = 1/2

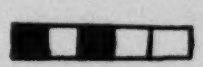
   a. 5/10 =  b. 12/15 =  c. 25/32 =

2. Copy and complete.

| Fraction | Decimal |
|---|---|
| a. 1/2 | ☐ |
| b. ☐ | .3 |
| c. 5/8 | ☐ |

3. Write a fraction (ratio) that correctly expresses the shaded parts to the total number of parts of the following figures.
   Example:  1/2

   a.

   b. 

   c.

   d.



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Using the set of cubes or rods provided by your teacher, carefully complete the introductory student worksheet.

Check you answers as directed by your teacher.



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## Introduction: Cubes

Use the set of cubes or rods to answer the following.

1. How many of the cubes are red? green?

2. There are _____ red cubes compared to _____ green cubes.

3. How many of the cubes are green? not green?

4. There are _____ green cubes compared to _____ cubes which are not green.

5. How many of the cubes are red or green?

6. There are _____ red cubes compared to _____ cubes which are red or green.

7. Now we will use fewer words. Compare the number of blue cubes to green cubes. _____ blue cubes to _____ green cubes

When comparing two groups, we sometimes compare only the numerals. Example: Compare 5 green cubes to 4 yellow cubes. Answer: 5 to 4 or 5:4

8. Compare red cubes to blue cubes. _____ to _____ or

_____:_____

9. Compare red cubes plus blue cubes: total. _____ to _____

10. Let's use the symbol instead of the words. Compare red:blue.

11. Compare red plus blue:total number of cubes. _____:_____

12. Compare red plus white:green plus blue. _____:_____

13. Another short cut: "green:blue" means: "compare the number of green cubes to the number of blue cubes".
blue:green = _____:_____

white:blue = _____:_____

red plus white:blue plus green = _____:_____



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Remove the chips from the envelope.

Complete worksheet # 1 and write the meaning of ratio in your own words on the back side of worksheet # 1. Compare your definition with another student's definition. Decide who is right.



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## Experiment I

Use the chips.

1. Give the ratio of yellow chips to all chips. _____ to _____
2. Give the ratio of yellow chips to red chips. _____ to _____
3. Give the ratio of white chips to green chips as a fraction. _____
4. Give the ratio of white chips to red plus blue chips. _____:_____
5. Give the ratio of blue plus green chips to yellow chips as a fraction in lowest terms.
6. Give the ratio of total chips to white chips as a fraction. _____
7. Give the ratio of red plus blue plus white chips to yellow chips.
   _____:_____
8. Give the ratio of red chips to blue plus green chips as a fraction in lowest terms.
9. Give the ratio of white plus blue chips to red chips as a fraction in lowest terms. _____
10. Give the ratio of green plus yellow chips to total chips. _____:_____



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Your teacher will provide you with a ruler and an envelope containing lengths of yarn.

Complete student worksheet #2.



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How long is each piece of yarn? red _____ green _____

blue _____ pink _____ white _____ yellow _____

1. Find the ratio of the length of the red to the length of the yellow. _____ to _____

2. Find the ratio of the length of the pink to the combined lengths of the green and yellow. _____ to _____

3. Find the ratio of the length of the red to the length of the white, as a fraction. _____

4. Give the ratio of the length of the white to the length of the pink as a fraction in lowest terms. _____

5. Find the ratio of the length of the pink to the combined lengths of the red and yellow. _____:_____

6. Give the ratio of the length of the pink to the length of the blue as a fraction in lowest terms. _____

7. Find the ratio of the combined lengths of the red and green to the combined lengths of the blue and pink. _____

8. Find the ratio of the length of the red to the length of the white as a fraction in lowest terms. _____

9. Give the ratio of the length of the yellow to the combined lengths of blue and pink as a fraction. _____

10. Find the ratio of the total combined lengths of all the yarns except red to the length of the red. _____:_____



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In order to complete Student Worksheet # 3B and Student Worksheet # 3C, which accompany this activity card, you will need the data provided on Student Worksheet #3A.

Make certain you understand how to simplify fractions before learning this experiment. Check your answers as directed by your teacher.



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## Vikings top Lions

The Vikings were able to hold off the Lions in a close hard fought game that wasn't decided until the final play.

Statistics

| | Vikings | Lions |
|---|---|---|
| First Downs | 17 | 12 |
| Rushing Yards | 188 | 172 |
| Passing Yards | 84 | 30 |
| Total Offense | 272 | 202 |
| Fumbles | 3 | 5 |
| Penalties | 20 | 85 |
| Score | 17 | 14 |

## Packers defeat Bears

The Packers easily out distanced the Bears in a game played during a driving rainstorm that saw players sliding and slipping from one end of the field to the other.

Statistics

| | Packers | Bears |
|---|---|---|
| First Downs | 28 | 4 |
| Rushing Yards | 286 | 17 |
| Passing Yards | 102 | 86 |
| Total Offense | 388 | 103 |
| Fumbles | 2 | 4 |
| Penalties | 15 | 30 |
| Score | 35 | 10 |



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Use the contents of envelope III to fill in the first two columns, then using the first two columns fill in the remaining columns.

| | Vikings | Lions | Ratio of Vikings to Lions | Ratio as a fraction | Simplest fraction |
|---|---|---|---|---|---|
| First Downs | | | : | | |
| Rushing Yards | | | : | | |
| Passing Yards | | | : | | |
| Total Offense | | | : | | |
| Fumbles | | | : | | |
| Penalties | | | : | | |
| Score | | | : | | |

| | Packers | Bears | Ratio of Packers to Bears | Ratio of a fraction | Simplest Fraction |
|---|---|---|---|---|---|
| First Downs | | | : | | |
| Rushing Yards | | | : | | |
| Passing Yards | | | : | | |
| Total Offense | | | : | | |
| Fumbles | | | : | | |
| Penalties | | | : | | |
| Score | | | : | | |

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## SAMPLE FOR WORK SHEET III

Directions: Fill in the missing numbers using your knowledge of ratio.

| | Eagles | Oilers | Ratio of Eagles to Oilers | Ratio as a Fraction | Simplest Fraction |
|---|---|---|---|---|---|
| First Downs | 12 | | 12 : | | 2/3 |
| Rushing Yards | 163 | 236 | : | | |
| Passing Yards | | 112 | : | 84/112 | |
| Total Offense | 120 | 265 | : | | |
| Fumbles | | 1 | : 1 | | 3/1 |
| Penalties | 1 | 4 | : | | |
| Score | 18 | 17 | : | | |

| | Falcons | Saints | Ratio of Saints to Falcons | Ratio as a fraction | Simplest Fractions |
|---|---|---|---|---|---|
| First Downs | | 21 | : | | 21/19 |
| Rushing Yards | 109 | 189 | : | | |
| Passing Yards | 155 | 163 | : | | |
| Total Offense | | 352 | : | 352/264 | |
| Fumbles | | | : 2 | | 2/1 |
| Penalties | 6 | | : | | 3/2 |
| Score | | 20 | : | | 5/9 |



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You need a multiple-speed bicycle for this experiment. The brake handle needs to be tied down so the wheel does not coast but still turns.

You also need to mark off the rear wheel with chalk into ten equal parts so you can determine what part of a rotation the wheel moves through.* Use the spokes to divide the tire into ten equal parts.

Turn the bicycle upside down, then record on the table on Student Worksheet #4 the results of your experiment as you compare the ratio of the pedal rotations and rear-wheel rotations.

*To determine how far apart the chalk marks should be. Multiply the wheel size by the constant - .309. Example: If the wheel size is 26 inches, then 26 x .309 = 8.03 so the marks should be approximately 8 inches apart.



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Fill in the following table:

| Row | First Gear | | Second Gear | | Third Gear | |
|---|---|---|---|---|---|---|
| | Number of Turns: | | Number of Turns: | | Number of Turns: | |
| | Pedal | Rear Wheel (in decimals) | Pedal | Rear Wheel (in decimals) | Pedal | Rear Wheel (in decimals) |
| 1 | 1 | | 1 | | 1 | |
| 2 | 3 | | 2 | | 3 | |
| 3 | 4 | | 4 | | 4 | |
| 4 | 7 | | 9 | | 7 | |
| 5 | 9 | | 12 | | 9 | |
| 6 | 12 | | 15 | | 15 | |
| 7 | 20 | | 20 | | 20 | |

Answer these questions:

1. State the ratio of the turns of the rear wheel to the turns of the pedal in second gear in the third row of the table.

2. Give the ratio of rear wheel turns in first gear to the rear wheel turns in third gear if the pedal turns 20 times.

3. Compare the ratio of pedal turns to rear wheel turns in the first row in all three gears. What do you notice?

4. In your own words explain how the different gears enable the bicycle rider to be more efficient when climbing hills.



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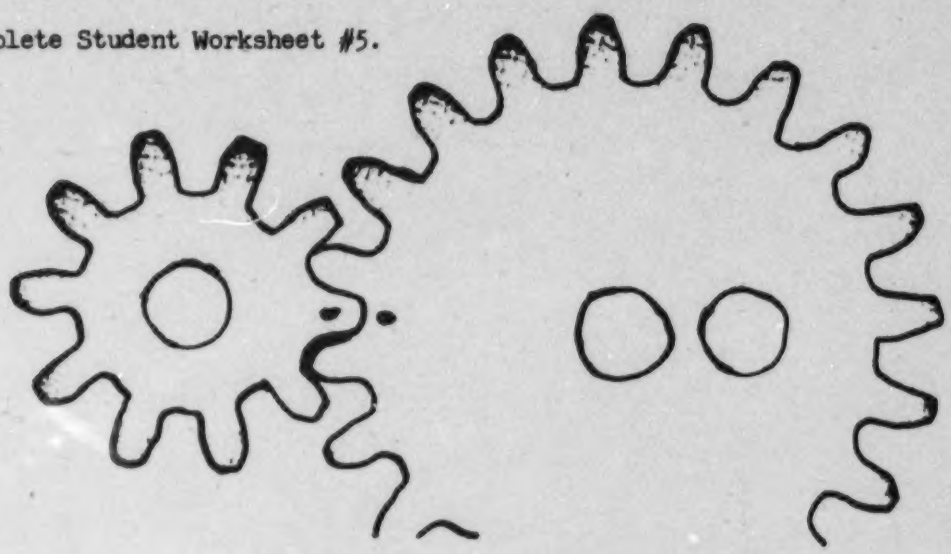
The teacher will provide you with the gear box and gears.

When the experiment begins, place the gear-teeth so the gear tooth and groove marked with dots of the same color are adjacent.

Complete Student Worksheet #5.





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## Comparing Gears (two at a time)

Be certain only two gears at a time are placed on the gearboard.

1. Determine what happens to the other gears when a specified gear is rotated a certain number of times. Show your results in simplified fraction form on the chart shown below.

| Name of Gear | Number of times rotated (Fractional part of a complete rotation. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | 2 | 1/2 | 5 | | | | | | | 1/6 | |
| B | 2/3 | | | | 2 | 1/2 | 5 | | | | | 1/6 |
| C | 3 | | | | | | | 2 | 1/2 | 5 | | |

2. How many teeth does each gear have?

   A. ____ B. ____ C. ____

*3. State in fraction form the simplest ratio of teeth in A to teeth in B. Teeth in A to teeth in C. Teeth in B to teeth in C.

   a. $\frac{\text{(teeth in A)}}{\text{(Teeth in B)}} =$ _____ b. $\frac{\text{(teeth in A)}}{\text{(teeth in C)}} =$ _____

   c. $\frac{\text{(Teeth in B)}}{\text{(Teeth in C)}} =$ _____

How do these ratios compare to those you found in problem 1 when rotations were compared?



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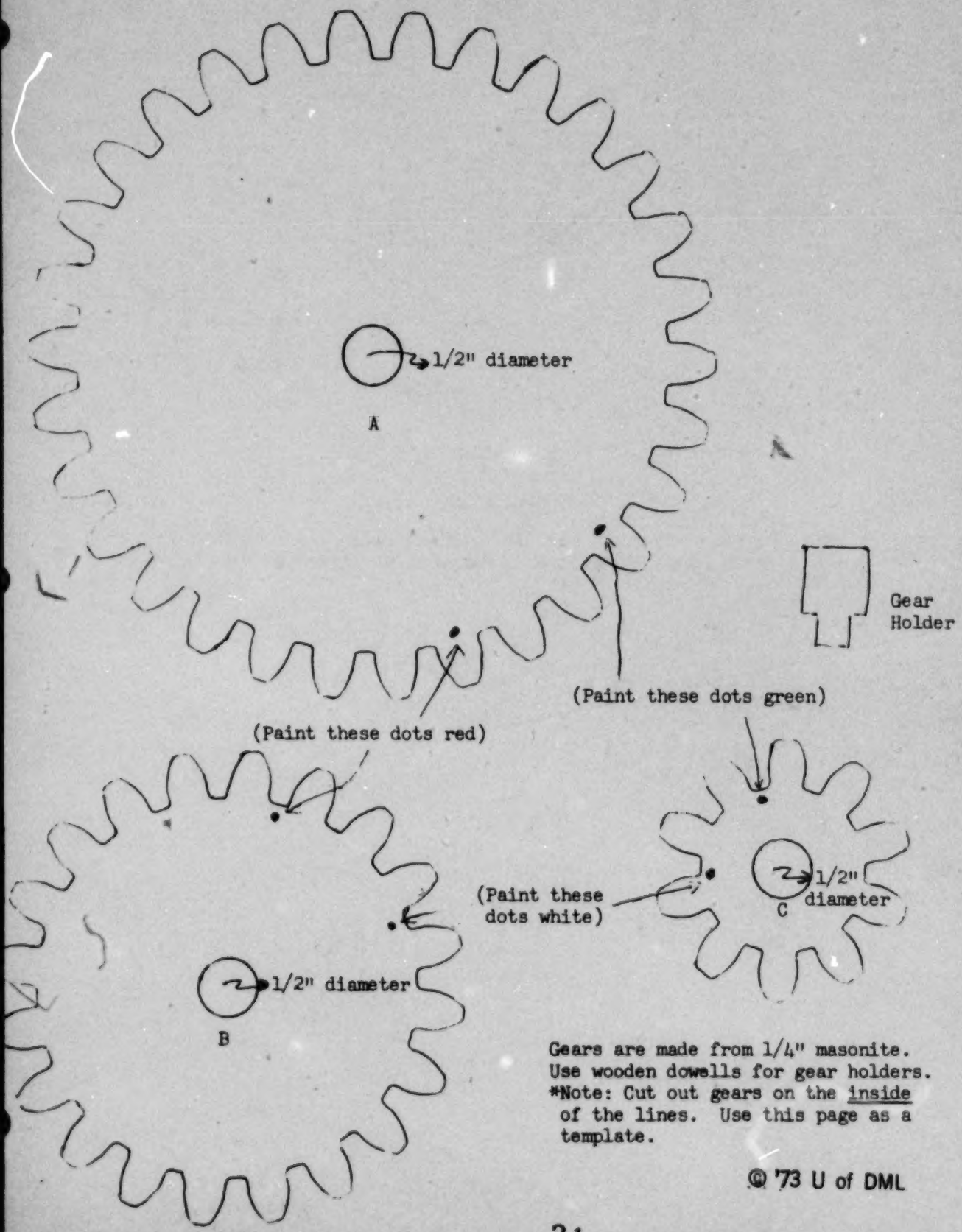
Experiment V Guide for gears.




Gears are made from 1/4" masonite.
Use wooden dowells for gear holders.
*Note: Cut out gears on the inside of the lines. Use this page as a template.

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Experiment V - Guide for construction of the gear board.

Board is made from 1/4" masonite. It should have the same dimensions as this drawing. For placement of holes use this page as a template.

1/4" diameter
B

1/4" diameter
C

1/4" diameter
A



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Select a deck of cards.

Examine the various types of cards, i.e. some are black, some red, some have numbers, some have letters.

The "face" cards (J, Q, K) are ranked so that J (Jack) ranks above the ten, then the Q (Queen), and finally the K (King). The A (Ace) can rank as the lowest, one, or the highest (thirteen). The suits are named:

Clubs, Diamonds,

Hearts, and Spades.

Complete Student Worksheet #6.



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## Introduction: Cards

Using the deck of cards answer the following questions dealing with ratio.

1. In the deck of cards there are _____ red cards compared to _____ cards.

2. There are _____ red aces compared to _____ face cards. (Aces and tens are not face cards.)

3. Compare the number of black face cards to the number of hearts. _____ black face cards to _____ hearts

4. Compare the total number of cards to the number of non-face cards. _____ total cards to _____ non-face cards.

5. Compare the number of black cards to the number of red face cards. _____ odd cards to _____ red face cards

6. Compare face cards to red cards. _____ to _____

7. Compare spades to red face cards. _____ to _____

8. Compare black cards:diamonds. _____ to _____

9. Compare black cards:red face cards. _____:_____

10. Compare black cards plus red face cards:total cards. _____ to _____

11. Another short cut: "Black face cards:diamonds" means "compare the number of black face cards to the number of diamonds cards".
    red face:red non-face - _____:_____
    black non-face:hearts - _____:_____
    diamonds:clubs - _____:_____



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## Time on Your Hands

a. Develop a method for comparing the area, on a wrist watch face, swept out by the minute hand with that swept out by the hour hand.

Do it for one minute, then show your comparison as a ratio.

b. Now compare the area swept out by the second hand to the area swept out by the hour hand. Compare these ratios for one hour, one day and one year. What do you notice?

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## Answers

a. The ratio comparing the area swept out by the minute hand compared to the area swept out by the hour hand is

$1:\frac{1}{12}$. It may be rewritten as 12:1.

b. $1:\frac{1}{60} = 60:1$. Note: $\frac{1}{\frac{1}{60}} = \frac{1 \times 60}{\frac{1}{60} \times 60} = \frac{60}{1}$



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## Spinning Your Wheels

a. What advantage does a car have if it is equipped with large tires (large radius)?

b. What advantage does a car have if it is equipped with small tires (small radius)?

c. Which tire, large or small, will give you the better gas mileage? Does the terrain make a difference?

d. Measure the radius and circumference of three different sized tires. For each tire compare the circumference to the radius as a ratio. What do you notice?



## Answers

a. Answers will vary. The car will have less power (less acceleration), but will likely be more efficient with greater maximum speed.

b. Answers will vary. Car will have more power, greater acceleration with decreased maximum speed.

c. Large tire will give better gas mileage on flat terrain.

d. $\frac{\text{Circumference}}{\text{Radius}} = \frac{2\pi}{1}$ (Student should find constant approximation to this.)



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Materials: 1 balloon, 1 felt pen, 1 ruler

a. Partially inflate a good-sized balloon. Using a felt pen draw a shape on the surface of the balloon which closely resembles a two-inch by three-inch rectangle. Assume that this shape is a rectangle. Compare its length to its width as a ratio expressed as a simplified fraction. Inflate the balloon so the length of the "rectangle" is doubled. Again compare the length to the width as a ratio expressed as a simplified fraction. What do you notice?

b. Partially deflate the balloon so the width is again two inches. Again assume the shape to be rectangular. Now compare the perimeter of the shape to the area of the shape as a ratio. Inflate the balloon so the perimeter is doubled. Find the ratio of the new perimeter to the new area. What do you notice about these ratios as compared with the ratios in part (a)?



Answers

a. The ratios in both cases should approximately equal to $\frac{3}{2}$.

b. $\frac{10}{6}$ or $\frac{5}{3}$ when "rectangle" is two inches by three inches.

$\frac{20}{24}$ or $\frac{5}{6}$ when perimeter is doubled, or four inches by six inches.

Note: these ratios are not equivalent.



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Ratio

## Posttest

Name: _____

Score: _____

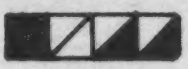
Time: _____

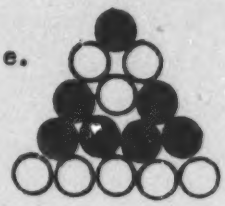
1. Write the ratio of the shaded parts to the total number of parts. (Each answer is worth 3 points.)

a.

b.

c.

d. 

e. 

2. True or False (Each answer is worth 3 points.)

a. $\frac{4}{7} = \frac{28}{42}$ b. $\frac{7}{19} = \frac{35}{95}$ c. $\frac{5}{23} = \frac{100}{2300}$

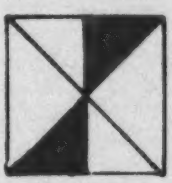
3. Replace $\square$ with $=$, $>$, or $<$ to make a true statement. (Each answer is worth 3 points.)

a. $\frac{1}{2} \square \frac{3}{6}$ b. $\frac{5}{12} \square \frac{3}{5}$ c. $\frac{11}{111} \square \frac{10}{100}$

4. Describe the shaded part of the square as a ratio in simplest fraction form. (Each answer is worth 3 points.)

a.

b.

c. 

5. The children of the Andersen family are: Amos, Rhonda, Albert, Rebecca, Ross, Ralph, Ann, Rudolph, Ricky, Sylvester, and Robert. Use a fraction to give the ratio of the number of (Each answer is worth 3 points.)

a. children whose names begin with "A" to the number whose names begin with "R".

b. children whose names begin with "A" to the total number of children.

c. children whose names contain the letter "e" to the number of people, including two parents, in the Andersen family.



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6. A dart board is divided into six equal parts. Each part is a different color. The colors are black, green, purple, red, white and yellow. What is the probability that a dart hitting the board at random will hit (Each answer is worth 3 points.)

a. yellow

b. some color other than black

c. the color is not white

d. a color whose name ends in "e"

7. Copy and complete. (Each answer is worth 3 points.)

| | fraction | decimal |
|---|---|---|
| a. | $\frac{5}{10}$ | — |
| b. | — | .4 |
| c. | — | 6.2 |
| d. | — | .24 |
| e. | $\frac{7}{8}$ | — |

8. Find the missing term. (Each answer is worth 3 points.)

a. $\frac{\quad}{5} = \frac{7}{35}$

b. $\frac{36}{21} = \frac{\quad}{7}$

c. $\frac{4}{\quad} = \frac{28}{42}$

d. $\frac{\quad}{8} = .25$

9. (Each answer is worth 5 points.)

a. Write as a ratio the number of teeth in gear A to the number of teeth in gear B.

b. How many times does gear A rotate when gear B rotates 5 times?



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